

Development and Demonstration of Innovative Distributed Power Interconnection and Control Systems

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Project Team

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Project Objectives and Goals

Develop key enabling technologies and system-level integration to help Distributed Power market participants more fully capture the total value provided by DP products.

- Cost-effective DP grid interconnection products, software, and communication solutions
- Improved economics for broad range of DP power systems
- Enhanced DP product capability to integrate, interact, and provide operational benefits
 - Within building energy management systems and electric power systems
 - Resource planning, ancillary services, and load/demand management

Three-Phase Work Plan

Base Year—Completed 2002

- Core Technology and Software Development
- Next generation GPC controller prototypes
 - Advanced controller and power sensing board
 - Significant performance enhancements
 - Expanded communication capabilities
 - Revenue-grade meter interface
 - DP device interconnect demonstration

Option Year One—Commencing 2003

Application and System Level Command and Control

- Type testing
- Controlled DP demonstration

Option Year Two—Planned 2004

Interoperability and Communications

- Further system benefits developments
- Validation of industry communication standards
- Grid-DP interoperability demonstration

Base Year Accomplishments

2001

- Core technology developments
 - Anti-islanding control scheme
 - Loss-of synchronization control scheme
- Functional product specifications outlined for advanced controller
 - More powerful processor
 - Enhanced controller architecture
- New controller provides several advances
 - Up to twenty fold improvement in processing speed
 - Reduced manufacturing costs
 - Simplified strategy for wiring and terminal connections
 - Reduced manufacturing and field installation costs
 - Expanded set of controller functions and scalability
 - Expanded communications capability

2002

- Modifying Base Year controller due to the following impacts on design requirements, testing and implementation:
 - Market feedback on new controller
 - Changes in overall DG market
 - P1547 standards development activities
 - Technology changes since inception
 - Chowchilla Case Study experience and results
- Controller Changes
 - Implementing a phased development approach
 - Eliminating features that were not cost effective
 - Leveraging analog board of current Goldbox
 - Added 2 additional RS232/485 serial I/O channels
 - PSM Improvements
 - Standalone capability
 - New DSP chip for greater functionality (not split control)
 - Modbus display capability

Significance of Base Year Accomplishments

- Important opportunity exists for further improving distributed power "value proposition"
- Advanced interconnection controls and switchgear a critical part of the equation
- Developing consensus IEEE standards for interconnection and communications vital
- Significant technical advances
 - Improved controller performance
 - Greater functionality
 - Reduced switchgear cost

Planned Accomplishments for Option Year I—2003-2004

Application and System Level Command and Control

- Type testing of advanced controller
 - Develop test plan
 - Perform testing and report results
- Development of system command and control system
 - Develop functional specification
 - Incorporate functions into controller
 - Develop extended dispatch capabilities
- Demonstration of controlled DP resources
 - Develop demonstration plan, implementing several DPs
 - Perform demonstration and report results



FIELD TESTING CASE STUDY: Chowchilla II 50 MW Power Plant (California)

- Wholesale-type DG application
- Application of GPC controller and related Encorp products
 - 16 natural gas fired Deutz generator sets (25 MW)
 - Owned and remotely operated by NRG Energy/NEO
 - Operated in parallel with utility (PG&E)

Wholesale Distributed Generation—ISO Capacity and Energy Trading Systems



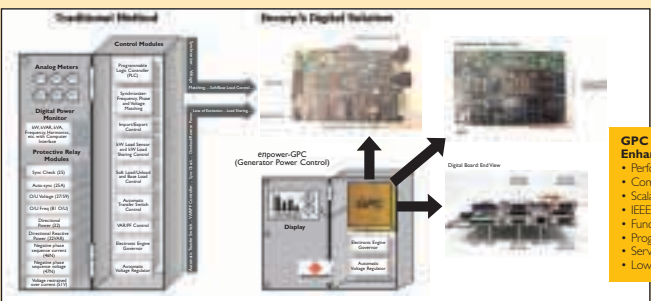
Chowchilla Communication Architecture



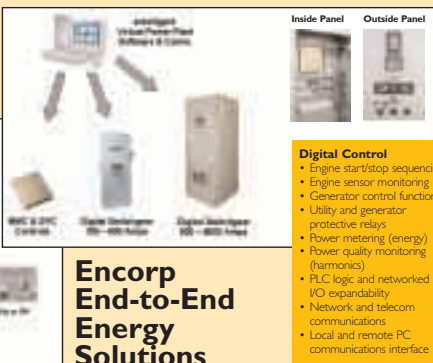
Results— Chowchilla Project Gives Valuable Insights on Future Distributed Power Needs

- Continued focus on customer "value proposition"
 - Cost savings
 - Expanded functionality
 - System-based solutions
- Importance of high-performance processing
- Importance of communications, monitoring, diagnostics
- Emphasis on ease of use and flexibility
- Satisfying needs and concerns of electric power system operators

Encorp's Differentiator: The Gold Box and Remote Energy Automation



- GPC Base Year Enhancements**
- Performance
 - Communications
 - Scalability
 - IEEE P1547 compliant
 - Functionality
 - Programmability
 - Serviceability
 - Lower system cost



- Digital Control**
- Engine start/stop sequencing
 - Engine sensor monitoring
 - Generator control functions
 - Utility and generator protective relays
 - Power metering (energy)
 - Power quality monitoring (harmonics)
 - PLC logic and networked I/O expandability
 - Network and telecom communications
 - Local and remote PC communications interface

**Encorp
End-to-End
Energy
Solutions**